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TITLE: Diffusion barrier coating for gas carburised steel - contains boron cpd. and resin film latter being removed under carburising conditions

PATENT-ASSIGNEE: L T LAKE[LAKEI]

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BASIC-ABSTRACT:

The barrier coating contains >=30 wt.% boric acid and/or B trioxide together with a synthetic film forming resin, pref. a polymer with ester and/or methacrylic ester units or a polymethacrylate. The resin is dissolved in an organic solvent e.g. xylene, and opt. the coating may also contain a small amt. of a high boiling coal tar distillate and C black filler. The compsn. flows readily over the surface to form a crack and pore free film which leaves no carbonaceous residues. Hot water rinsing is sufficient to remove the remaining material after carburising.

TITLE-TERMS: DIFFUSION BARRIER COATING GAS CARBURISE STEEL CONTAIN BORON COMPOUND RESIN FILM LATTER REMOVE CARBURISE CONDITION

DERWENT-CLASS: A14 A82 M14

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(54) COMPOSITION AND PROCESS FOR THE SURFACE TREATMENT OF STEEL

(71) I, LESLIE THOMAS LAKE, a British subject of "Clanbaniffe", Beer, Devon, do hereby declare the invention, for which I pray that a patent may be granted to me, and the method by which it is to be performed, to be particularly described in and by the following statement:—

It is often desirable to treat surface areas, e.g. bearing surfaces, of steel parts in order to harden these areas and thus prolong the useful life of the parts. The surface hardening can be effected by various types of heat treatment e.g. gas carburisation. However, certain portions of the surface areas of steel parts normally have to be kept soft for machining operations, such as thread cutting, or for pressure welding. Paint-type materials are known for this purpose, the material being applied to the surface areas to be kept soft and the residue removed after the heat treatment.

In British Patent Specification No. 890,541 the use of boric acid or boron trioxide to protect certain surface areas of steel parts from hardening on heat treatment is described. Alternatively and preferably, it may be applied in suspension in a solution of an anhydrous binder for instance an organic binder such as a synthetic resin and an inert filler, e.g. alumina, may also be present.

I have found that, in gas carburisation, although the use of an organic binder in a composition to protect surface areas from hardening is very desirable as far as the application of the effective protecting material is concerned, organic binders generally have one or more disadvantages.

In gas carburisation the parts are heated and maintained, usually at a temperature of at least 850°C, most often in the range of 850 to 900°C, in a reducing atmosphere comprising a carbon-containing gas. Depending on the carburisation conditions, the type of steel and the degree of hardening desired, the duration of the treatment is usually from two hours to several days e.g. three days.

[Price 25p]

The reducing atmosphere may comprise, for example, methane and/or carbon monoxide. It is often convenient to use propane, natural gas or town gas to provide the necessary atmosphere. Many organic binders char, i.e. leave a carbonaceous residue, on heating and this effect is more marked if heating is in a reducing atmosphere. Accordingly, it would be expected that most organic binders would char under gas carburisation conditions and in fact charring has previously occurred and has been thought to be desirable. Thus, in Specification No. 890,541 mentioned above it is indicated that, on heating up in the furnace, the organic binder as such is destroyed but leaves coking residues embedded as fillers in the melting boric acid or boric acid anhydride and that, if insufficient coking residue is produced, the addition of substances, such as alumina, that do not melt at the temperature in question can be advantageous.

In accordance with the present invention I have found that a surprisingly advantageous process for hardening only certain surface areas of a steel part comprises applying, to those surface areas not to be hardened, a composition comprising boric acid and/or boron trioxide, a synthetic film-forming resin that is removable under gas carburisation conditions without leaving a carbonaceous residue and an organic solvent for the resin, allowing or causing the solvent to evaporate and subjecting the steel part to gas carburisation. Thus I have found that charring is most undesirable since it may lead to flaking and thus loss of the effective protecting material. Also, after gas carburisation it is desirable that any residue left of a protecting composition should be easily removable e.g. by washing with warm or hot water. If, however, a charred residue is left this is liable to be difficult to remove satisfactorily.

Novel compositions that are particularly useful in the process for protecting those surface areas which are to be kept soft on gas

carburisation contain the boric acid and/or boron trioxide in an amount of at least 30% by weight.

A class of synthetic resins useful in the compositions are homopolymers or copolymers of acrylic of methacrylic esters, e.g. lower alkyl esters such as the methyl and ethyl esters, and copolymers of one or more such monomers with one or more additional monomers e.g. ethylene. Resins of this type can easily be removed under gas carburisation conditions without leaving a carbonaceous residue.

By use of suitable amounts of solvents in the compositions these can be given a suitable consistency for whatever method of application, e.g. dipping, brushing or spraying, is to be used. The resin should have a chemical composition and sufficiently low molecular weight that it is soluble in organic solvents.

The compositions are advantageous in that not only can very effective protection be readily obtained but also, after the gas carburisation, any residues can easily be removed e.g. by washing with warm or hot water. The ease of removal of residues is a valuable advantage since, with known methods of protection, this has commonly been a rather time-consuming operation. A further advantage of the composition is that, after the residual matter has been removed by washing, the exposed surface is normally bright and free of residual stains.

Compositions of a thin consistency which will flow readily can be formulated and these are easy to apply and very good protection can be achieved by the thin films so obtained. The dried layer of protecting material is generally free of any substantial discontinuities like cracks or pores and gives good protection against hardening to the areas of the parts where it is present.

The compositions generally comprise at least 5% by weight of the resin, preferably at least 10%. The amount of resin present will not usually exceed 30% by weight but higher amounts, e.g. in the range of 30 to 50% by weight, may be useful in certain circumstances, depending on the nature of the resin and the method of application to be used. The amount of boric acid and/or boron trioxide will usually be at least 30% by weight, preferably from 45 to 75%.

The compositions comprise an organic solvent and examples of suitable types of solvent are medium boiling aromatic solvents, e.g. xylene, and chlorinated solvents, e.g. trichloroethylene. Mixtures of solvents e.g. xylene or solvent naphtha containing a small proportion of a solvent of a different type, e.g. diacetone alcohol may be used. A suitable solvent or solvent mixture not only serves to dissolve the synthetic resin but is also of value in adjusting the consistency of the compositions to suit any particular method of application. The amount of solvent used will not normally exceed 40% by weight of the composition. The amount will usually be at least 7.5% by weight, e.g. 10% by weight or more and preferably will be in the range of 10 to 30% by weight.

I have found that it is advantageous to include a high boiling coal tar distillate in the compositions. The addition of even relatively small amounts, e.g. 0.5% by weight, preferably 1 to 10% by weight of coal tar distillate, preferably having a boiling point above 250°C, materially improves the film-forming properties of the compositions.

The compositions may contain further components: the presence of, for example, a small amount, e.g. 1% to 10% by weight, of a pigment such as carbon black is advantageous. However, inert fillers such as alumina are not helpful since their presence tends to dilute the active constituents of the compositions without contributing to their effectiveness.

The compositions can be formed by simply stirring the components together or by use of apparatus such as a colloid dispersing device. As already mentioned the compositions may be applied to the steel parts by dipping, brushing or spraying. The time taken for the layer of composition on the steel part to become usable will depend on the ambient temperature and on the thickness of the layer applied and on the particular nature of the composition. However, the layer will generally be usable within half an hour of application and often after an appreciably smaller interval.

EXAMPLE.

A composition for protecting certain surface areas of steel parts from hardening on gas carburisation was made by mixing together the following ingredients:—

	parts by weight
Boric Acid	100
'Bedacryl' 122X (Imperial Chemical Industries Limited)	35 (solids)
Carbon Black	2
Epitar HA3 (Midland Tar Distillers)	2
Xylene	20
Diacetone Alcohol	2

'Bedacryl' 122X is a 46% solution in xylene of a poly methacrylate and Epitar HA3 is a high boiling coal tar fraction. ('Bedacryl' is a Trade Mark.)

The composition was applied, by dipping, to certain surface areas, to be protected during gas carburisation, of steel parts and the solvents allowed to evaporate. The parts were then subjected to gas carburisation in a carburisation furnace at 900°C using a town gas atmosphere. Carburisation was carried out for various periods ranging from two hours to three days. The untreated surface areas became hardened to varying extents, depending on the carburisation period, just as in entirely conventional gas carburisation processes. In each case the treatment provided the treated areas with the necessary protection against hardening and the residue was easily removed by rinsing with hot water to leave the protected areas bright and free of stains.

WHAT I CLAIM IS:—

1. A composition for protecting certain surface areas of steel parts which areas are to be kept soft on gas carburisation comprising at least 30% by weight of boric acid and/or boron trioxide, a synthetic film-forming resin that is removable under gas carburisation conditions without leaving a carbonaceous residue and an organic solvent for the resin.

2. A composition according to claim 1 in which the resin is a polymer having acrylic ester and/or methacrylic ester units.

3. A composition according to claim 2 in which the resin is a polymethacrylate.

4. A composition according to any preceding claim comprising at least 5% by weight of the resin and at least 7.5% by weight of the solvent.

5. A composition according to claim 4 comprising 10 to 30% by weight of the resin, 45 to 75% by weight of the boric acid and/or boron trioxide and 10 to 30% by weight of the solvent.

6. A composition according to any preceding claim additionally comprising a high boiling coal tar distillate.

7. A composition according to claim 1 substantially as hereinbefore described with reference to the Example.

8. A process for hardening only certain surface areas of a steel part which process comprises applying a composition comprising boric acid and/or boron trioxide, a synthetic film-forming resin that is removable under gas carburisation conditions without leaving a carbonaceous residue and an organic solvent for the resin to those surface areas not to be hardened, allowing or causing the solvent to evaporate and subjecting the steel part to gas carburisation.

9. A process according to claim 8 in which the composition is a composition according to any of claims 1 to 7.

10. A steel part treated by a process according to claim 8 or claim 9.

For the Applicant:—
GILL, JENNINGS & EVERY,
Chartered Patent Agents,
51/52 Chancery Lane,
London, WC2A 1HN.

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